## REMARKS

Claims 2, 4, 6, and 8 were rejected under 35 U.S.C .§112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention. Claims 2, 4, 6, and 8 have now been cancelled. Claims 9 - 10 are added. Claims 1, 5, 9 - 10 remain in the case.

Claims 1 - 4 were rejected under 35 U.S.C .§103(a) as being unpatentable over Schwalm in view of Waka et al. Claims 2 - 4 are now cancelled. The rejection of claim 1 is traversed. Claims 5 - 8 were rejected under 35 U.S.C .§102(b) as being anticipated by Schwalm. Claims 6 - 8 have now been cancelled. The rejection of claim 5 is traversed.

> To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently... Anticipation of a patent claim requires a finding that the claim at issue "reads on" a prior art reference. Atlas Powder Co. v. IRECO Inc., 51 USPQ 2nd, 1943, 1945 - 46 (Fed. Cir. 1999).

Schwalm does not show or disclose a gas analysis means at least having an instrument for measuring a thermal conductivity for analyzing a composition of the atmospheric gas in the carburizing chamber during carburization. The Examiner cites that Schwalm discloses that the carbon potential may be determined by measuring flame temperature. Flame temperature is not the same as thermal conductivity and there is no correlation or calculation to obtain the thermal conductivity of a gas from the flame temperature as discussed hereinafter. The Examiner states that Stark (U. S. Patent Number 6,086,251) gives an indication that thermal conductivity can be calculated from temperature measurements. Stark discloses a method for measuring only velocity and thermal conductivity of a gas. However, a relationship between thermal conductivity and flame temperature is not disclosed at all. Namely, although the temperature and the thermal conductivity of gas are related, the thermal conductivity is not related to the measurement of flame temperature at all.

The principle of a thermal conductor or sensor catches an electromotive power generated during reduction of a filament temperature when a gas touches the

heated filament, etc. At this time, if the gas is burned, since it changes to another physical property such as flame temperature, it makes it impossible to measure the thermal conductivity which the original gas has.

In the following Table 1, the thermal conductivity without gas burning and the flame temperature at gas burning in air is shown.

Table 1 Thermal conductivities of various gases (at 15°C of 1atm) and theoretical flame temperature.

| | Thermal conductivity [kcal/mh°C] | Theoretical flame temperature [°C] |
|---|---|---|
| $H_2$ | 0.160 | 2250 |
| CO | 0.021 | 2390 |
| $CH_4$ | 0.028 | 2050 |
| $C_3H_8$ | 0.025 | 2150 |
| $C_4H_{10}$ | 0.023 | 2200 |

For example, as shown in Table 1, when $CH_4$ and $H_2$ are assumed to be generated within a vacuum carburization furnace, the thermal conductivities of $CH_4$ and $H_2$ are 0.028 and 0.160 kcal/mh°C, respectively. Namely, the thermal conductivity of $H_2$ is 5.7 times as large as that of $CH_4$.

On the other hand, since the flame temperatures of $CH_4$ and $H_2$ are 2050°C and 2250°C, respectively, the flame temperature of $H_2$, is only about 1.1 times that of $CH_4$, that is, their differences are slight compared with the thermal conductivity. Moreover, when $H_2$ and CO are compared, although the thermal conductivity of $H_2$ is larger than that of CO, as for the flame temperature, CO becomes larger that $H_2$, conversely. Thus, the thermal conductivity of gas and flame temperature are not related completely.

Furthermore, as shown in the following equation (1), since there is no direct relation between the thermal conductivity and flame temperature, it is impossible to calculate the thermal conductivity from the flame temperature.

$$Tth = (Ht + q) / (\Sigma g\ Cp) \qquad (1)$$

Here Tth is a theoretical flame temperature, Cp is an average specific heat between 0°C and Tth°C (kcal/$Nm^3$ °C). Ht is an actual heat value of combustible gas and (kcal/$Nm^3$), q is a retaining calorific value of air and combustible gas (kcal/$Nm^3$), and g is a volume of combustion product ($Nm^3$).

In summary, in Schwalm, although measurement of flame temperature is disclosed, there is no direct relation between the flame temperature and the thermal conductivity, as described above. Moreover, in each of Schwalm and Waka et al., maintaining an atmosphere gas containing less than 20% by volume of carbon monoxide is not disclosed at all.

Therefore, since neither of the Schwalm and Waka et al. inventions discloses or suggests of the above unique feature and the equivalent remarkable effect of the present invention cannot be obtained , inevitably the present invention has novelty and the inventiveness over the Schwalm, Waka et al. references and their combination. Therefore, claim 1 is believed to be allowable.

Further, Schwalm does not show or disclose a pressure adjustment means for changing the pressure inside of the carburizing chamber according to the analysis result by the gas analysis means. Therefore, the prior art reference of Schwalm does not disclose every limitation of claim 5. Therefore, claim 5 is believed to be allowable.

Claims 9 and 10 are added in a different format but contain all of the elements disclosed in the previous claims 1 - 8 and, therefore, new claims 9 and 10 have no new issues requiring a new search.

This Amendment should place this case in condition for passing to issue. Such action is requested.

Respectfully submitted,

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